



Civil UAV Applications in Japan and Related Safety & Certification

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5. Japanese Working Group dealing with certification
6. Conclusion

Introduction

1500 Unmanned Helicopters are used for civil applications in Japan.

1. Reasons why an unmanned Helicopter was developed and how it became popular in Japan.
2. What kind of certifications are applied in agricultural use of unmanned helicopters ?
3. Recently developed autonomous unmanned helicopter extends civil applications
4. Background and Objectives of the Japanese Working Group dealing with certification.

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1. Introduction



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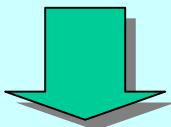
Background and Development

of the Unmanned Helicopter agricultural use

Chemical Spraying for rice field.

In 1958, 'Manned Helicopter' use started.

(In 1992, 27 % of rice fields sprayed by 'Manned Helicopter'.)

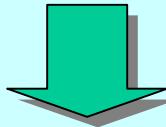


Complaint of Residents.

Necessary for Farmers.

In 1982, YAMAHA started to develop Unmanned Helicopter.

In 1990, YAMAHA put it on the market.



Other companies joined this market.

In 2000, 24 % of rice fields sprayed by 'Manned Helicopter'

10 % by Unmanned Helicopter.



Industrial Use of Unmanned Helicopter for agricultural use

YAMAHA



R50



RMAX

	R50	RMAX
Main Rotor Diameter(mm)	3,070	3,115
Tail Rotor Diameter(mm)	520	545
Overall Length(mm)	3,580	3,630
Overall Height(mm)	1,080	1,080
Overall Width(mm)	700	720
Empty Weight(kg)	47	64
Payload(kg)	20	30
Engine		
Displacement(cc)	98	246
Category		Water Cooled 2 Stroke
Maximum Output(KW)	8.8	15.4



Industrial Use of Unmanned Helicopter for agricultural use

YANMAR



YH300

Fuji Heavy Industry



RPH2

KAWADA



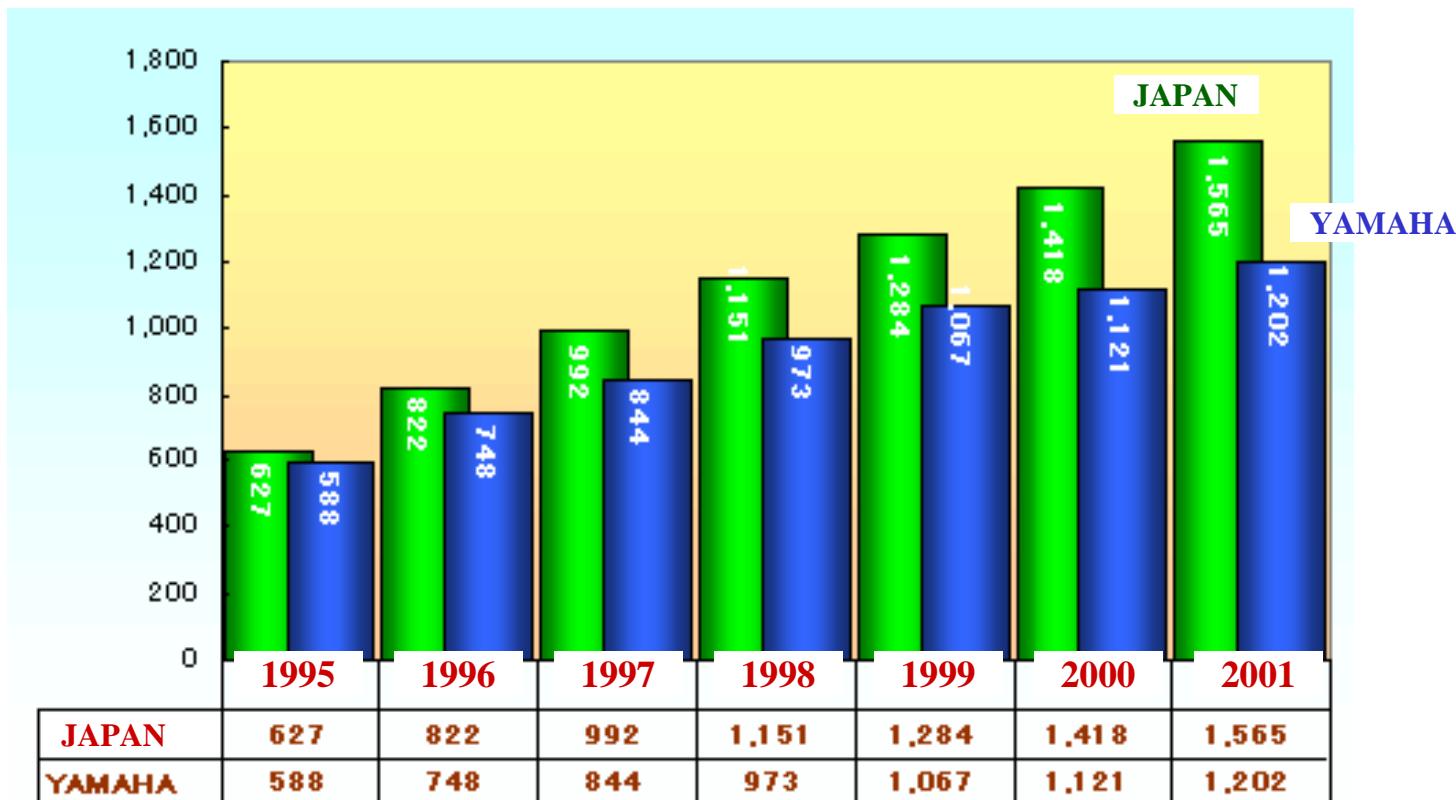
RoboCopter

	YH300	RPH2	Robo Copter
Main Rotor Diameter(mm)	3,38	4,800	8,180
Overall Height(mm)	1,150	1,750	2,650
Empty Weight(kg)	58	230	500
Payload(kg)	30	100	294
Engine			
Maximum Output(KW)	14.7	61.4	124



Registered Number of Unmanned Helicopter for agricultural use

YAMAHA maintains 80 % share .



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Industrial Use of Unmanned Helicopter for agricultural use

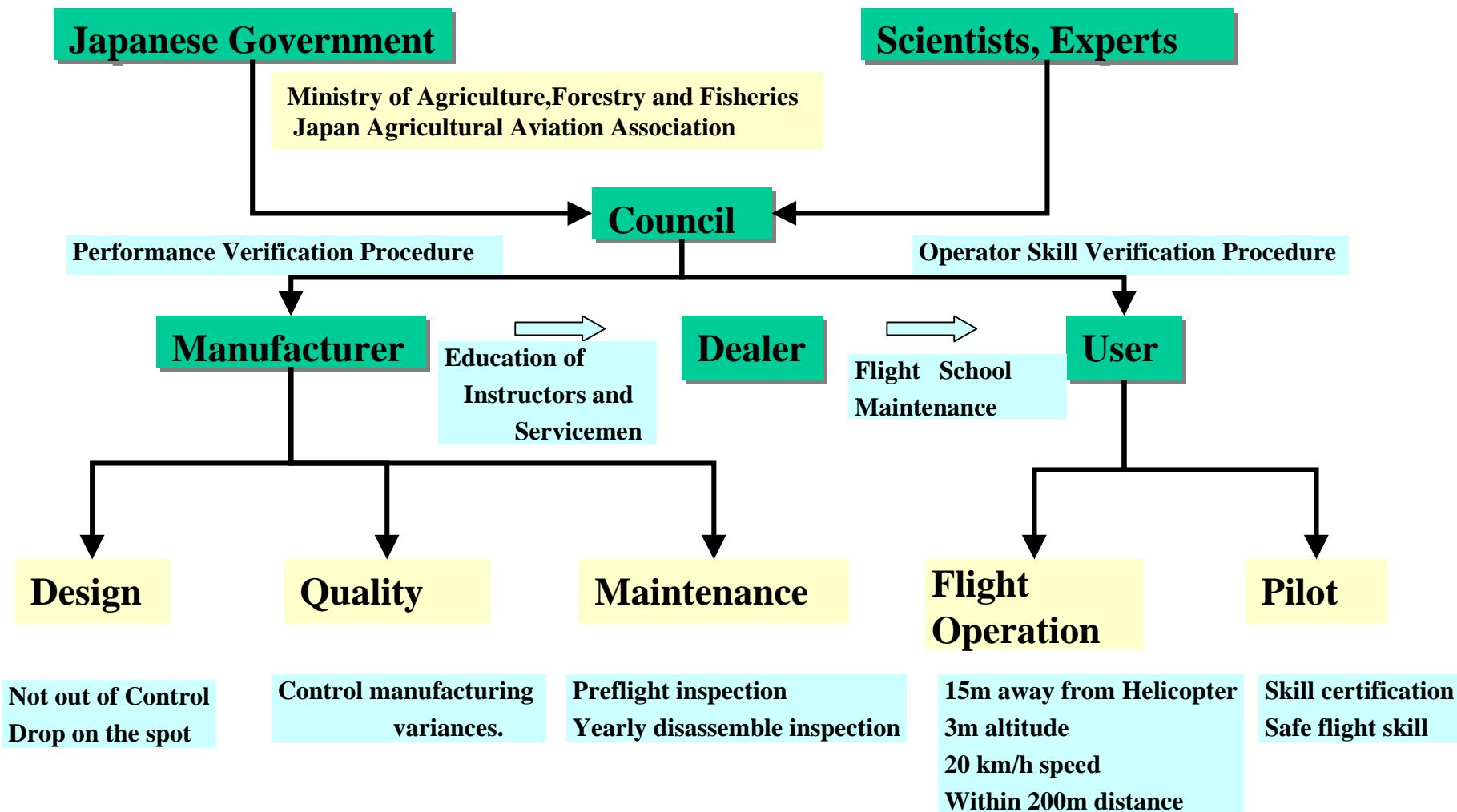
Safety Operations for Chemical Spraying

1. No crew on the Helicopter
2. Low speed (20 km/h) and Low altitude(3-5m)
3. Safety Standard by Japanese Government
Structure, Flight Performance, Inspection, Maintenance
Operator License ,Operator Registration System

YAMAHA Safety First Policy

1. Various Tests for reliability and durability
2. Maintenance Training for Serviceman
3. Periodical Maintenance

Outline of Operational Safety in Agricultural Applications



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Background and Development of Autonomous Helicopter

Japan is famous for volcanoes and earthquakes.

In 1990 - Unzen volcano erupted.

In 1995 - the Great Hanshin Earthquake

In 1997, YAMAHA started to develop
Autonomous Unmanned Helicopter for disaster use.

In 1999, YAMAHA established a prototype model.

In 2000, Observation role at Mt.Usu

In 2001, Observation role on Miyake-jima Island



Observation Flight at Mt.Usu



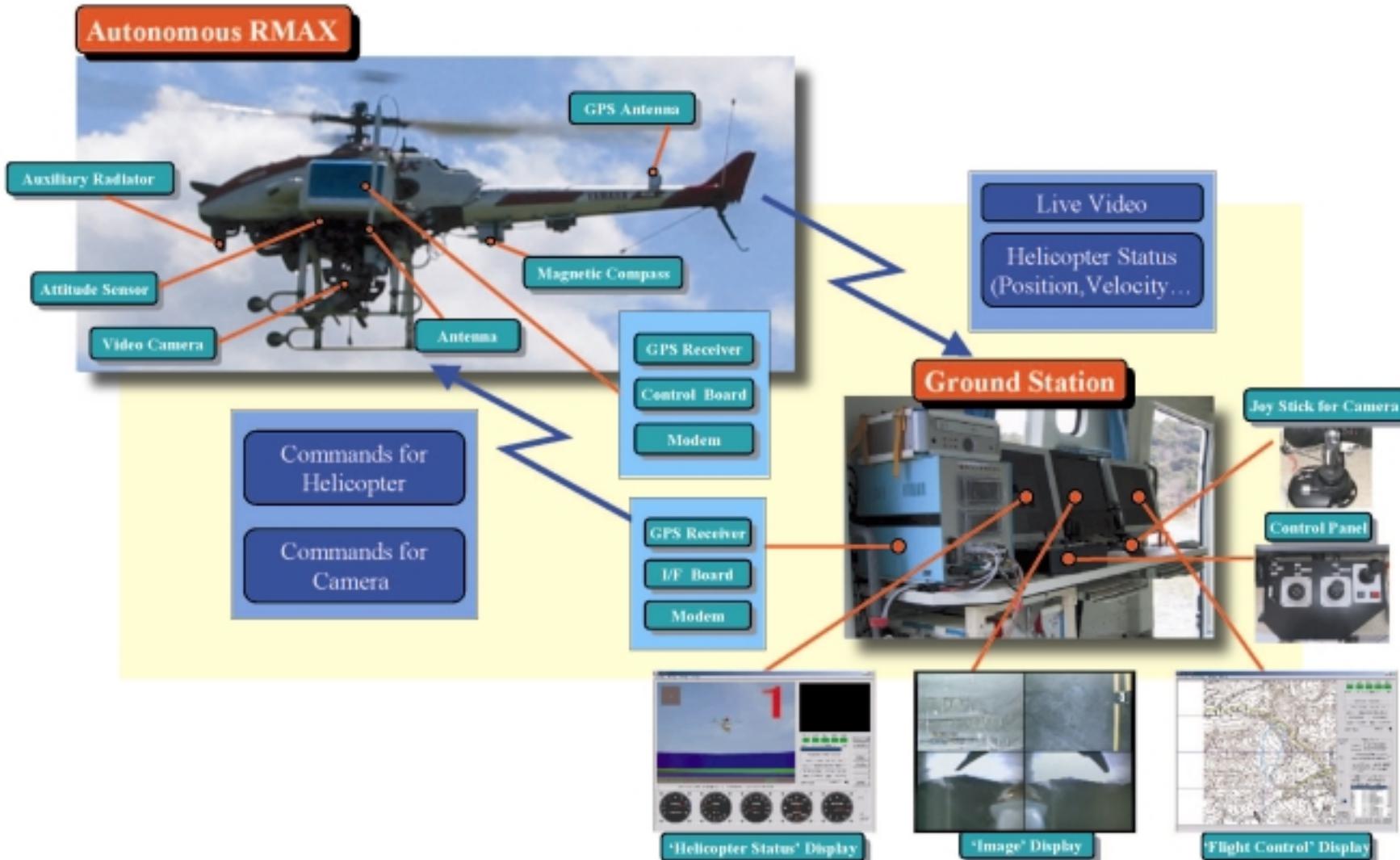
Destroyed Houses



A Crater



Autonomous Flight Control System for YAMAHA RMAX





Fuji Heavy Industry RPH2 Commercial Unmanned Helicopter

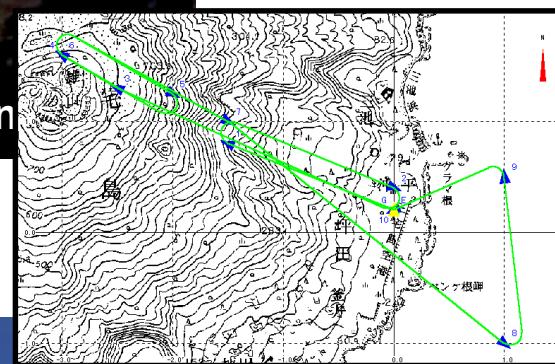


R P H 2 –Agricultural Spraying

- Gross Weight 330kg
- Rotor Diameter 4.8m



R P H 2 A –Observation



- In Service for Agricultural Spraying
- Payload up to 100kg
- Operational range < 250m
- Operational altitude < 50m

- In Service for Volcano Observing by Japan Meteorological Agency

- Autonomous Flight
- Operational range > 3km
- Ceiling > 2000m
- Endurance > 1hr



Applications of Autonomous YAMAHA Unmanned Helicopter

Observation of Volcanoes

April 2000 at Erupting Volcanoes Mt.Usu
(The Ministry of Construction)



February 2000 at Miyake-jima Island
(The Tokyo Metropolitan Government)

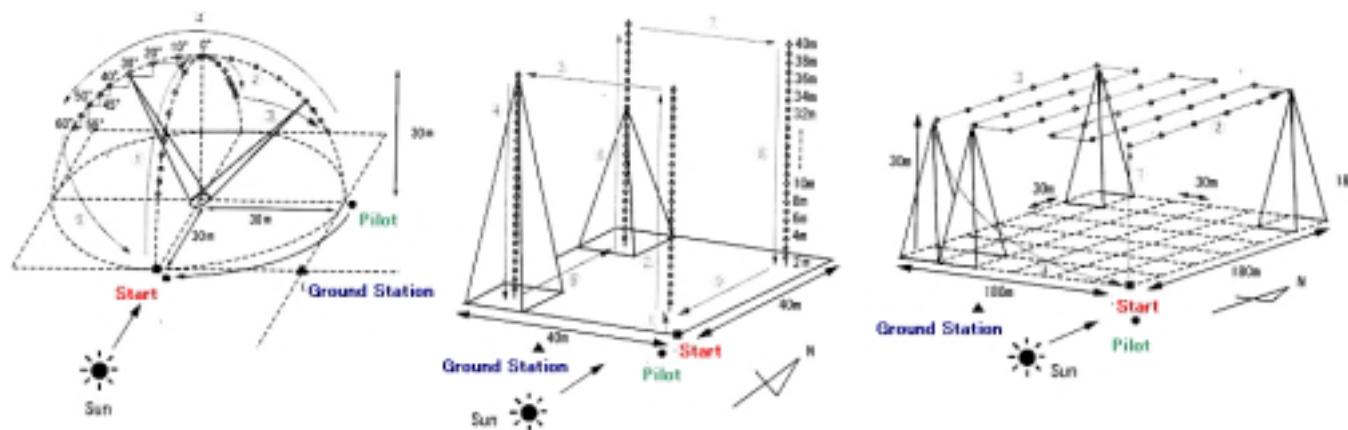




Applications of Autonomous Unmanned Helicopter

Observation of Plant Growth

In August 1999, the investigative observation of vegetation
was performed in Mongolia.
(The Environment Remote-Sensing Research Center of Chiba University)





Applications of Autonomous Unmanned Helicopter

Radiation Monitoring for Nuclear Emergency

Japan Nuclear Cycle Development Institute and YAMAHA
have succeeded to monitor radiation.

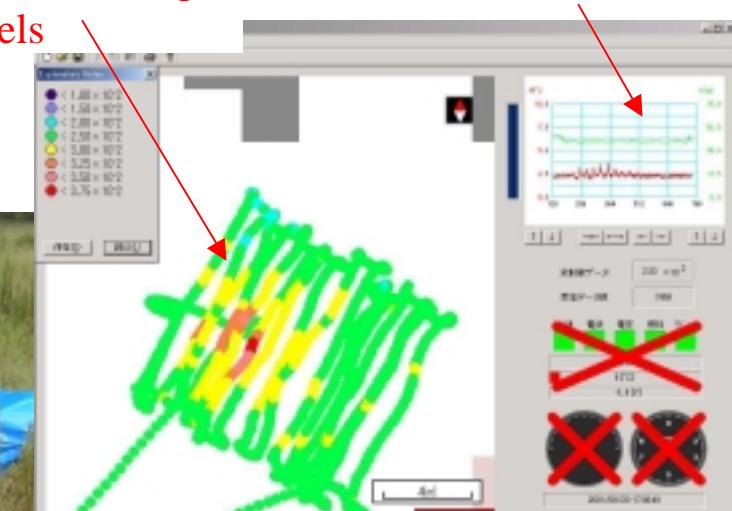


Color indicator showing
radiation levels



Radiation Sources
(Agricultural chemicals containing potassium(K-40))

Variation of radiation (red)
and altitude (green)





YAMAHA

Applications of Autonomous Unmanned Helicopter

Inspection of damage for high-ways

The Japan Highway Public Corporation and YAMAHA
have succeeded to inspect the damage
of bridges and banks of high-
ways.



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Japanese Working Group dealing with the certification

Since April 2002, Japanese Working Group has been founded to deal with UAV-related certification and ATM issues.

Background

- Up to date approximately 1,500 commercial unmanned helicopters have been used with in-sight control for agriculture application in Japan. (Operational Altitude < 50 meters)
- Recent development of fully autonomous VTOL-UAVs capable of out-of-sight control extends its application into civil managed airspace. (Operational Altitude > 150 meters)
- The absence of relevant regulations applicable to UAVs flown within the civil managed airspace is starting to be addressed by Japanese government authorities and Japanese UAV-related manufacturers.
- It activates the Japanese industry to generate a voluntary group to study such issues on a national level, not only by liaising closely with the government authorities, but also in concert with the international program aiming at internationally acceptable rules.



Japanese Working Group dealing with the certification

Since April 2002, Japanese Working Group has been founded to deal with UAV-related certification and ATM issues.

Objectives

- To develop recommendations for principal rules & regulations applicable to civil UAVs flown over Japan.
- To coordinate the international efforts relative to UAV certification & ATM issues.
- To submit consensual proposals representing the Japanese industry.
- To supply inputs to keep all the interested Japanese government authorities informed.

Members

- Kawada Industries Inc., Fuji Heavy Industries Ltd., Yamaha Motor Co.Ltd.,
Yanmar Helicopter Services (in alphabetical order)
(observed by)
- Japan Ministry of Economy, Trade and Industry, (Japan Civil Aviation Bureau),
Japan Agricultural Aviation Association.



Proposed Categories by the Japanese Working Group

Flight Conditions \ Configuration	Fixed Wings	Rotor Wings	Other
High Level Fault Tolerant Aircraft	Flying the same area as manned aircrafts	In addition to the criteria indicated below, collision avoidance measures must be taken to prevent the unmanned helicopters from colliding with manned aircrafts.	Although no specifics have been set currently, the rules (of High Level Fault Tolerant Aircraft) will be studied continuously after standard Level Fault Tolerant Crafts.
	Flying over inhabited area	A failsafe system, which can guide the unmanned helicopter to a safe area in the event of any type of failure, must be provided.	
Standard Level Fault Tolerant Crafts	Flight out of sight of uninhabited areas	Autonomous control device requirements to be added in addition to the flight criteria for the area within sight indicated below.	
	Flight within sight of uninhabited areas	Flight criteria for the altitudes between 100 to 150 meters to be added to the criteria indicated below. (This category is applied to helicopters that are flown within sight even if they are equipped with an autonomous control device.)	
	Agricultural chemical spraying application	Unmanned helicopter for spraying agricultural chemicals (base machine)	
General UAV	Hobby radio-controlled helicopters	Rules exist in each country around the world for radio-controlled devices	
	Micro UAV	The rules are very lenient, involving weight restrictions of several hundreds of grams and rotor protection criteria.	

Next Step



First Step



Conclusion

For Agricultural Use

1. Unmanned Helicopters are inevitable for Japanese Agriculture.
2. For safety, the Japanese government made certifications and a license.

For Other Applications

1. Autonomous unmanned helicopters have been developed and they are playing observation roles at erupting volcanoes.
2. Autonomous unmanned helicopters expands their applications.

Japanese Working Group

1. Japanese UAV manufacturers found working group to deal with UAV-related certification and ATM issues.
2. Liaising closely with the Japanese government and harmonizing with the international program.